US009561430B2

(12) **United States Patent**
Gomez et al.

(10) **Patent No.: US 9,561,430 B2**
(45) **Date of Patent: Feb. 7, 2017**

(54) **ROLLOVER SWITCH FOR AN AMUSEMENT GAME DEVICE**

(71) Applicant: **Stern Pinball, Inc.**, Melrose Park, IL (US)

(72) Inventors: **George A. Gomez**, Chicago, IL (US); **Thomas M. Kopera**, Villa Park, IL (US)

(73) Assignee: **Stern Pinball, Inc.**, Melrose Park, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 85 days.

(21) Appl. No.: **14/528,501**

(22) Filed: **Oct. 30, 2014**

(65) **Prior Publication Data**

US 2016/0121202 A1 May 5, 2016

(51) **Int. Cl.**
A63F 7/30 (2006.01)
A63F 7/02 (2006.01)

(52) **U.S. Cl.**
CPC ***A63F 7/3065*** (2013.01); *A63F 7/027* (2013.01)

(58) **Field of Classification Search**
USPC . 273/121 R, 121 A, 118 A, 119 A; 446/485, 446/484, 175, 219, 220; 403/7, 118, 200; 411/292
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,180,267 A * 12/1979 Harrop ..... A63F 7/3065 273/118 A
4,360,203 A * 11/1982 Garbark A63F 7/3065 200/61.11
4,438,930 A * 3/1984 Peters ..... A63F 7/3065 273/127 R
5,333,866 A 8/1994 Tanzer et al.
5,338,031 A 8/1994 Patla, Sr. et al.
5,509,655 A * 4/1996 Ugawa ..... G07F 17/3297 273/118 A
5,529,294 A * 6/1996 Nordman ..... A63F 7/3065 273/118 A
5,806,851 A * 9/1998 Gomez ..... A63F 7/3075 273/118 A
6,158,737 A 12/2000 Cornell et al.
2007/0026918 A1 2/2007 Sheats
2010/0165613 A1 * 7/2010 Rorick F21V 23/0414 362/206
2013/0300058 A1 * 11/2013 Stellenberg ..... A63F 7/027 273/121 A

OTHER PUBLICATIONS

Sparkfun, Jul. 14, 2011, p. 1 Description.*
ISA/US, International Search Report and Written Opinion issued on PCT application No. US15/58366, dated Jan. 22, 2016, 8 pages.

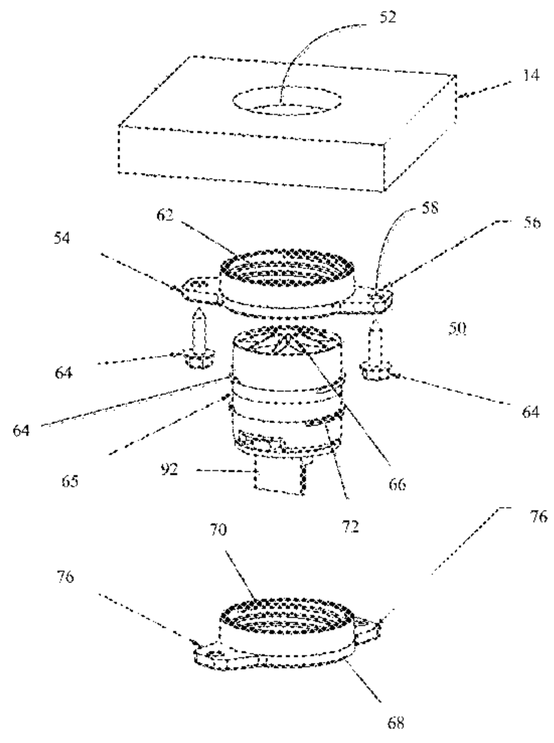
* cited by examiner

Primary Examiner — Gene Kim
Assistant Examiner — Rayshun Peng
(74) *Attorney, Agent, or Firm* — Greenberg Traurig, LLP

(57) **ABSTRACT**

A rollover switch has a housing carrying a depressible cover coupled to a switch whereby a depression of the cover in response to contact being made between the cover and an object movable across a first surface of a playfield of an amusement game functions to activate the switch. A mounting collar is sized to be positioned within an opening formed in the playfield wherein the opening extends between a second surface of the playfield and the first surface of the playfield. The mounting collar and the housing of the switch assembly have cooperating features that allow the switch assembly to be adjustably mounted within the mounting collar to thereby allow the cover to be positioned at a desired location relative to the first surface of the playfield.

7 Claims, 4 Drawing Sheets



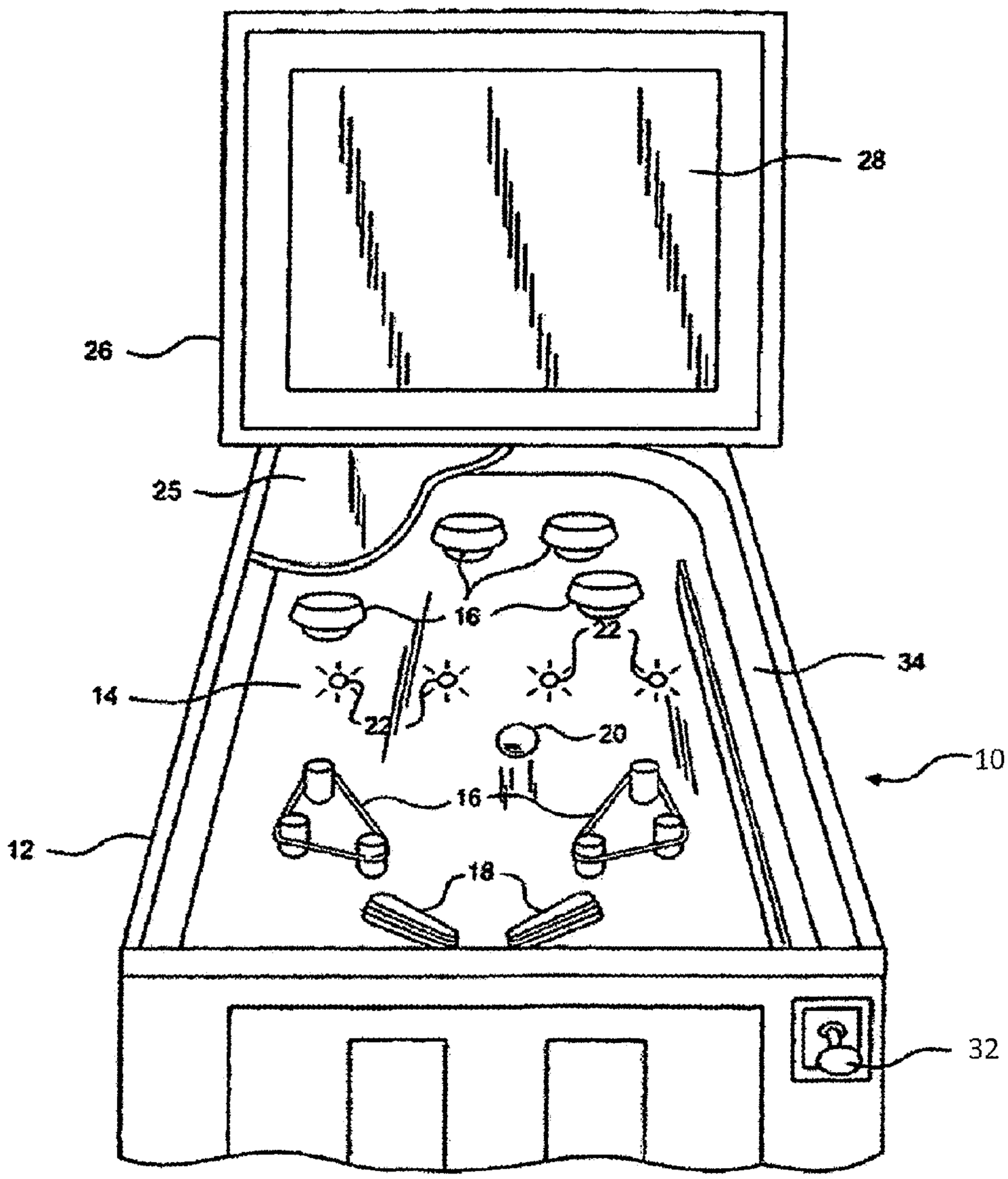


FIGURE 1

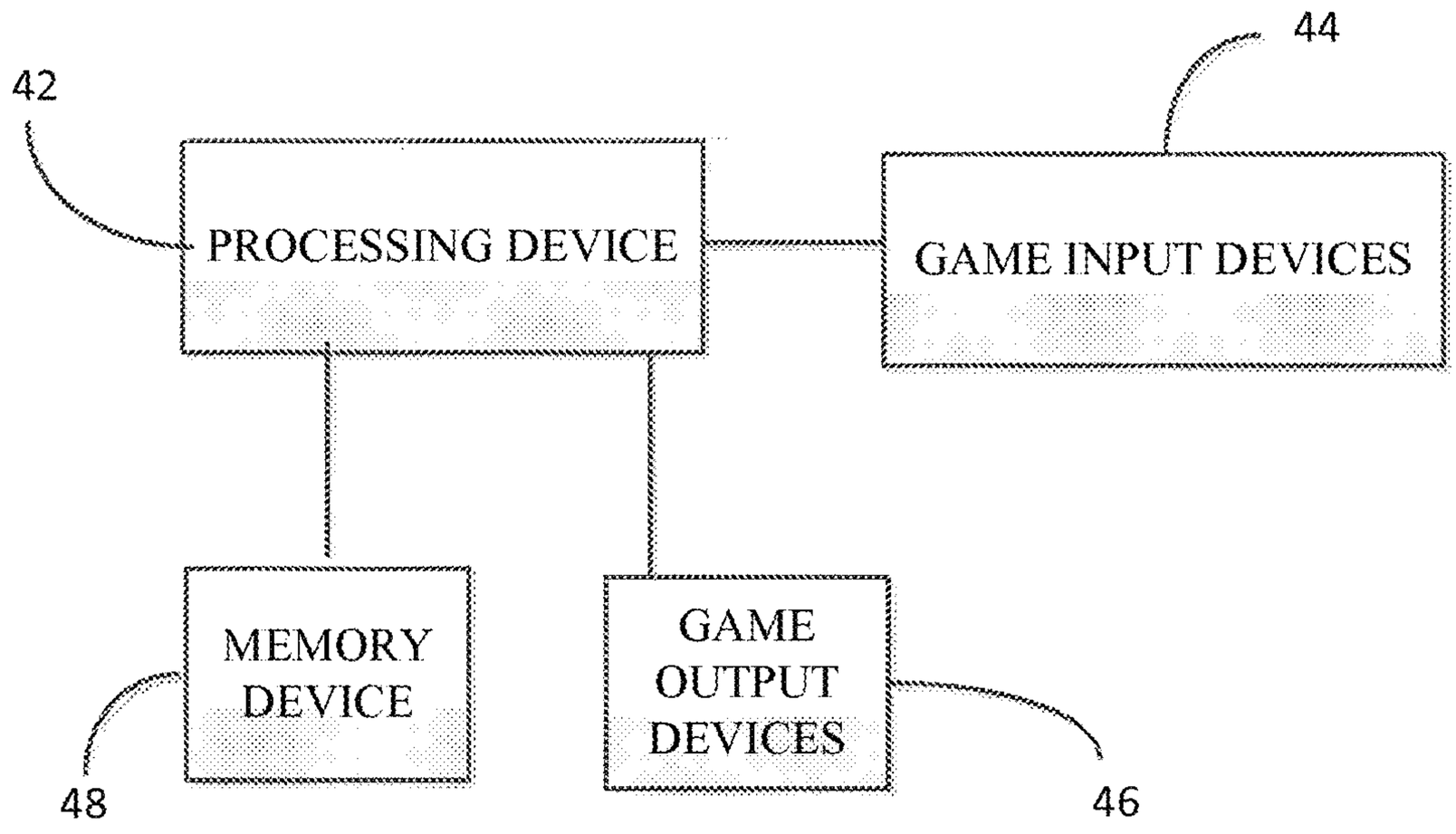

42
PROCESSING DEVICE
44
GAME INPUT DEVICES
MEMORY DEVICE
48
GAME OUTPUT DEVICES
46

FIGURE 2

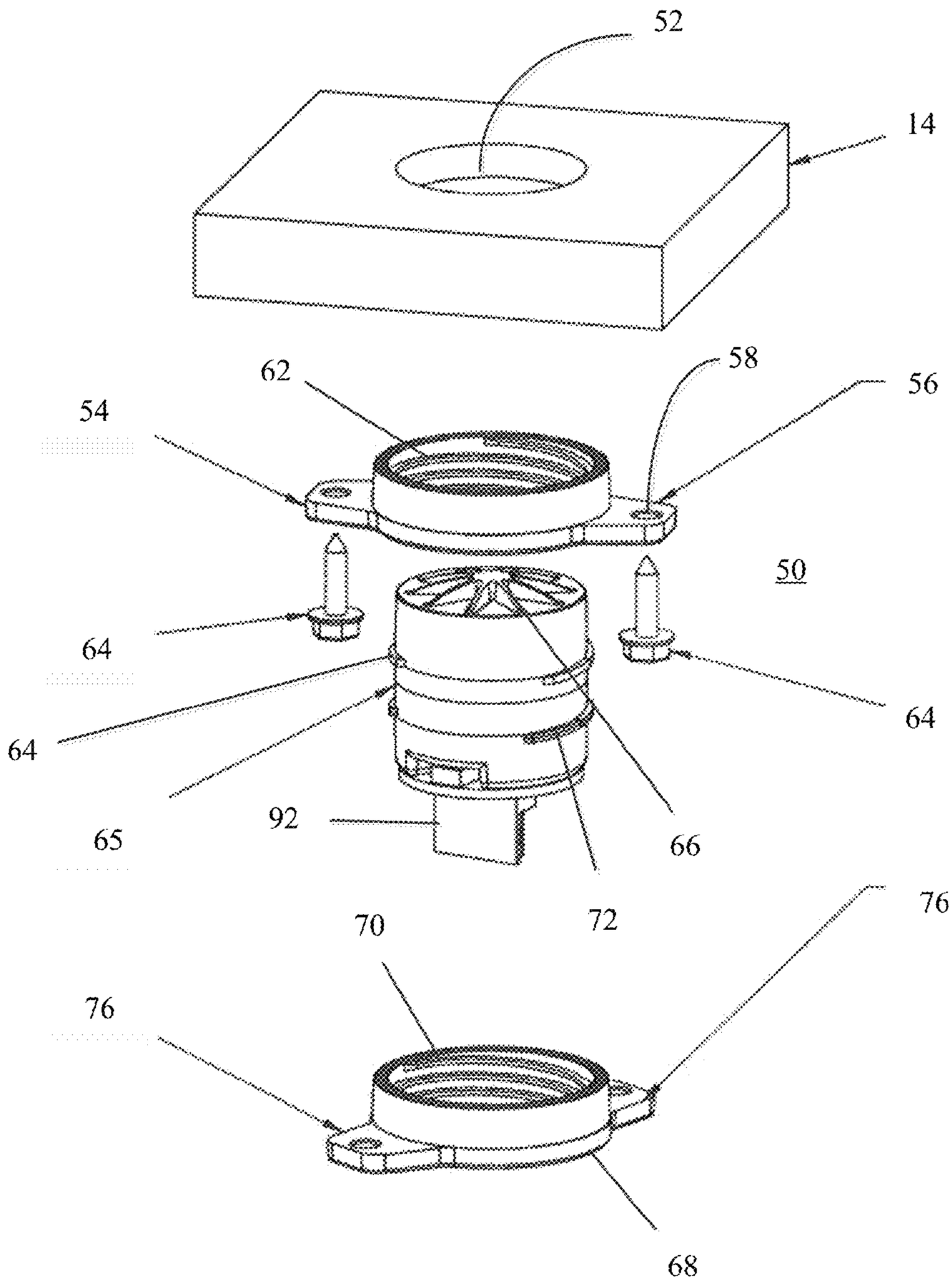


FIGURE 3

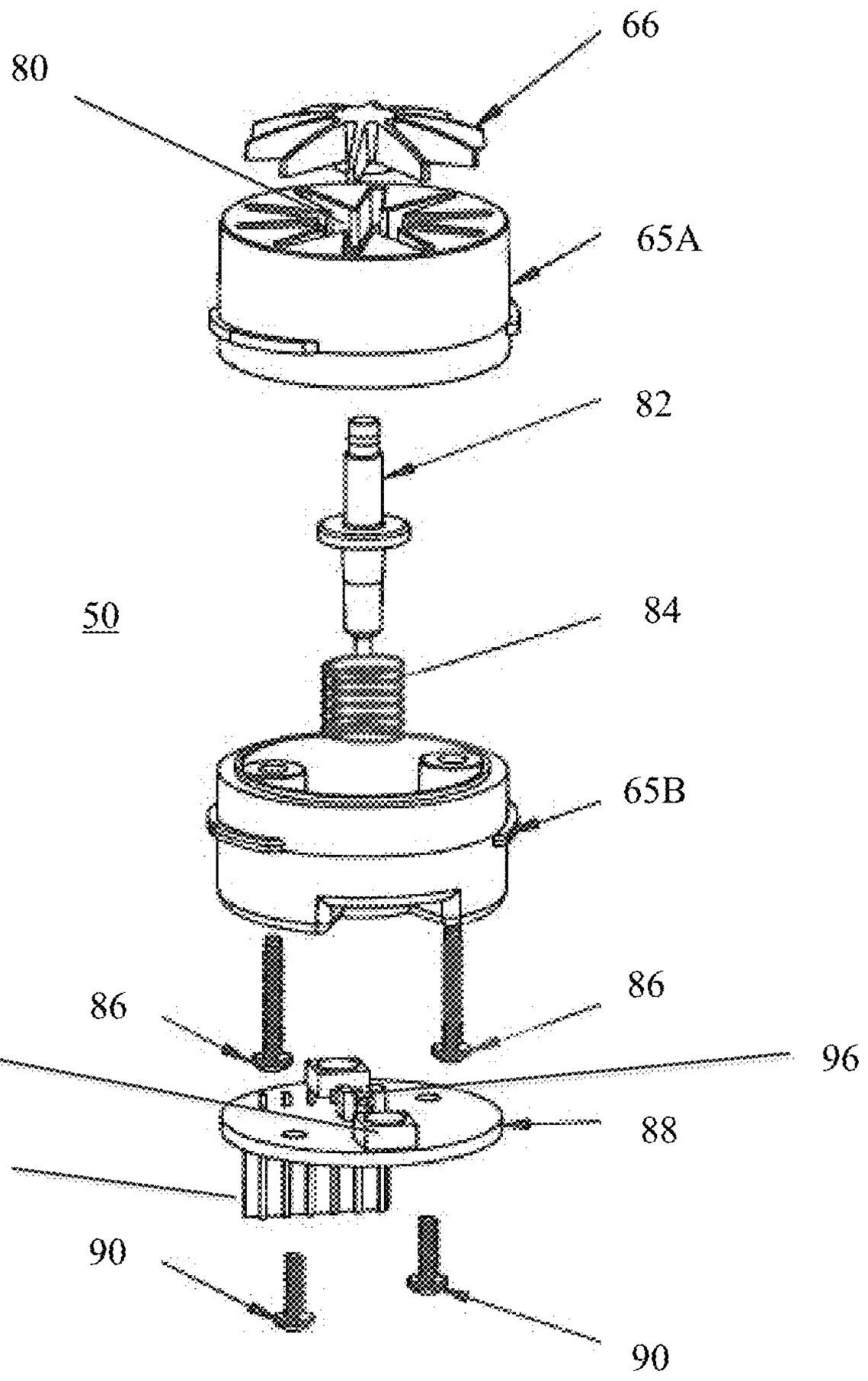


FIGURE 4

ROLLOVER SWITCH FOR AN AMUSEMENT GAME DEVICE

BACKGROUND

Amusement game devices, such as pinball machines, redemption games, etc. of the commercial, e.g., revenue generating, and non-commercial, e.g., home entertainment, type are well known in the art. By way of example, U.S. Pat. Nos. 5,338,031, 6,158,737, and U.S. Published Application No. 2007/0026918 illustrate and describe amusement game devices of the type having a cabinet which houses a playfield.

Rollover switches for use on the playfield of such amusement game devices are also known in the art. By way of example, U.S. Pat. No. 4,360,203 ("the '203 patent") illustrates and describes a rollover switch having a switch actuator, comprised of a deformable star shaped cover element coupled to a plunger, a support structure for supporting the switch actuator upon the playfield, and a leaf switch which, when activated by the plunger in response to a ball rolling over the star shaped cover element, functions to send a signal to a processing device of the amusement game. The described rollover switch also includes a lamp which can be illuminated to, for example, indicate that the rollover switch is available for scoring, to indicate that the player has completed or achieved actuating or registering of the switch, and/or the like in accordance with the programmed play instructions of the amusement game device.

While rollover switches such as described in the '203 patent generally work for their intended purpose, they do suffer various disadvantages. For example, after the support structure is inserted into the playfield board and glued therein, the entire playfield board must be sanded in order to assure that the support structure is perfectly flush with the playfield board otherwise the ball could skip over the support structure and thereby create an undesirable condition, e.g., the ball can become airborne and miss the cover element preventing activation of the leaf switch, can cause the ball to become hung up on an edge of the support structure (particularly when the rollover switch is placed in a lane with rails or walls on either side), or the like. Because the finishing operations for the playfield, e.g., the application of silkscreened or digitally printed art and the final sprayed protective clear hard coat, usually a self-leveling urethane finish coat, is applied after the support structure is installed and the playfield sanded, it has been seen that the finishing materials, particularly, the clear hard coat, tend to fill, clog, or otherwise impede the movability of one or more components of the actuator switch which thus requires additional finishing operations to be performed to thereby restore the rollover switch to operability. As will be appreciated, the need to perform all of these operations, which are generally too difficult to implement consistently, undesirably adds to the overall cost of manufacture of the amusement game device.

SUMMARY

The following describes an improved rollover switch for an amusement game. Generally, the rollover switch has a housing in which is carried a depressible cover. The depressible cover is coupled to a switch. When the cover is depressed in response to contact being made between the cover and an object that moves across a first surface of a playfield of the amusement game the switch is caused to be activated. For mounting the rollover switch to the playfield of the amusement game a mounting collar is provided. The mounting collar is sized to be positioned within an opening that is formed in the playfield. The mounting collar and the housing of the rollover switch are provided with cooperating features that allow the rollover switch to be adjustably mounted within the mounting collar to thereby allow the cover to be positioned at a desired location relative to the first surface of the playfield.

A better understanding of the objects, advantages, features, properties and relationships of the subject rollover switch will be obtained from the following detailed description and accompanying drawings which set forth illustrative embodiments which are indicative of the various ways in which the principles of the rollover switch may be employed.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the rollover switch described hereinafter reference may be had to the following drawings in which:

FIG. **1** illustrates an exemplary amusement game device in the form of a pinball machine;

FIG. **2** is an exemplary block diagram of exemplary components of the amusement game device of FIG. **1**;

FIG. **3** is an exploded view of a rollerover switch assembly and playfield mounting elements; and

FIG. **4** is an exploded view of the rollover switch assembly of FIG. **3**.

DETAILED DESCRIPTION

With reference to the Figures, an amusement game device, in the exemplary form of a pinball machine **10** is now described. It is to be appreciated, however, that this exemplary form for the amusement game device **10** is not intended to be limiting. Rather, those of ordinary skill in the art will appreciated that the rollover switch described hereinafter can be utilized in any type of amusement game device of the commercial and non-commercial type in which it is desired to sense an object moving over a sensing switch.

In keeping with the example of an amusement game device **10** of the pinball machine type, the amusement game device **10** illustrated in FIG. **1** includes a cabinet **12** which houses various apparatus used to define play of a game. Game play may be commenced in response to insertion of money—paper or coins referred to collectively as "coins"—into a coin accepting device, upon exercising of credits earned, by accepting payment from an account, e.g., via use of a swipe card reading device, a bar code reading device, a near field communications device, etc., and/or by otherwise making game play active. Upon activation of the game in this manner, game play, in the case of a pinball machine, is defined upon an inclined playfield **14** that supports a number of playfield accessories or devices. More particularly, in the case of a pinball machine, game play is generally defined through the use of a pair of flippers **18** to propel a ball relative to the playfield **14** and input devices/accessories associated with the playfield **14**. The playfield **14** is usually inclined from the horizontal such that the ball tends to eventually roll back down the playfield **14** in the direction of the flippers **18**. While not intended to be limiting, the playfield accessories or input devices **16** may include elements such as bumpers, ramps, and/or targets as well as one or more rollover switches **22** which will be described in greater detail hereinafter. The playfield **14** may be covered by a transparent or glass sheet cover **25** to permit viewing of

the playfield **14**. In addition to the foregoing, the playfield **14** includes a plunger element **32** which shoots the ball up an alley **34** onto the playfield **14**. The playfield **14** may also include lighting elements—which may also be included as a part of the rollover switches **22**—and/or other features as desired. Other player-activated input elements, typically in the form of push-buttons on the sides of the cabinet **12**, are usually provided for controlling operation of the flippers **18**. The amusement game **10** may also include a backbox **26** which is mounted to overlay a top rear portion of the cabinet **12** and which contains a game display **28**, such as a dot matrix display, CRT, LED or plasma display, or the like. The backbox **26** may also support speakers associated with the game sound system. Within the backbox **26** may be located various ones of the electronic devices/circuits for controlling the operation of the playfield, the display, general illumination, and the sound system. Such electronic devices/circuits could also, in whole or in part, be carried within the game cabinet **12**.

For controlling the various devices that form the amusement game **10**, the amusement game **10** is provided with a processing device **42** which processing device **42** is, in turn, coupled to game input devices **44**, such as switches associated with the cabinet **12**, playfield **14** (including rollover switches **22**), etc., and game output devices **46**, such as lights (including lights associated with rollover switches **22**), flippers **18**, display **28**, etc. via one or more bus systems as shown in FIG. **2**. A memory device **48**, such as a RAM, ROM, or the like, stores instructions and data usable by the processing device **42** to control play of the game, the game output devices **46**, and the game input devices **44** as necessary based upon signals provided by the game input devices **44**. It is to be understood that this illustrated embodiment is not intended to be limiting and that other manners for arranging the devices illustrated in FIG. **2** to provide for control of play of the amusement game can be utilized as needed.

Turning now to FIGS. **3** and **4**, an exemplary rollover switch assembly and structure for mounting the rollover switch assembly to the playfield **14** is described. Generally, the rollover switch assembly **50** is mounted within an opening **52** that is formed in the playfield **14**. To this end, a mounting collar **54**, which is adapted to adjustably receive the switch assembly **50**, is sized to be fit within the opening **52** of the playfield **14**. Extending from the mounting collar **54** are one or more flanges **56** each having a fastener **60** accepting opening **58**. As will be appreciated, fasteners **60** are to be passed through the fastener accepting openings **58** to thereby attach the flanges **56** to the underside of the playfield **14** and to thereby mount the mounting collar **54** to the playfield within the opening **52**.

For adjustably receiving the switch assembly **50**, an interior surface of the mounting collar **54** is provided with a screw thread **62** which is cooperable with a screw thread **64** that is provided to the exterior surface of the housing **65** of the rollover switch assembly **50**. In this manner, the rollover switch assembly **50** can be screwed into the mounting collar **54** such that the top of the switch assembly housing **65** is positioned flush to the top surface of the playfield **14** with the rollover switch cover element **66** extending above the top surface of the playfield **14** to thereby allow the rollover switch cover element **66** to be exposed for contact with and depression by a ball rolling thereover as will be discussed in greater detail hereinafter. While the use of the cooperating screw threads **62** and **64** are preferred as it allows the positioning of the switch assembly **50** relative to the top of the playfield **14** to be finely adjusted as desired, it is to be understood that other cooperating adjustment mechanisms can be provided to the switch assembly **50** and mounting collar **54** to meet the above noted objectives.

To maintain the switch assembly **50** within the mounting collar **54** in the desire position, a locking collar **68** is further provided. The locking collar **65** is likewise provided with a screw thread **70** which is cooperable with a screw thread **72** that is provides to the exterior surface of the housing **65** of the rollover switch assembly **50**. In this regard, the locking collar **65** is to be screwed onto the rollover switch assembly **50** until the locking collar **65** becomes frictionally engaged with the mounting collar **54** to thereby prevent the rollover switch assembly **50** from moving relative to the mounting collar **54**. For ease of installing the locking collar **65** upon the rollover switch assembly, the locking collar **65** may be provided with one or more flanges **76**. The one or more flanges **76** are provided to be grasped by a user or a tool to thereby allow the user or the tool to quickly rotate the locking collar **65** relative to the rollover switch assembly **50**. It will also be appreciated that the flanges **76** can be omitted with the outer surface of the locking collar **65** instead being provided with a hexagonal or the like shape having one or more relatively flat or non-outwardly rounded surfaces for this same purpose.

For sensing when an object rolls over the rollover switch assembly **50** when properly installed on a playfield **14** as described above, the rollover switch assembly **50** includes a cover element **66** which is preferably in the shape of a star. It will be understood, however, that this shape is not intended to be limiting. The cover element **66** is positioned within a complementary opening **80** provided to an upper housing section **65**A of the housing **65** such that at least a portion of the cover element **66** extends above a top surface of the upper housing section **65**A to thereby allow the cover element **66** to be exposed for contact with and depression by a ball rolling thereover. The cover element **66** is coupled to a post **82** and the post **82** floats upon a spring **84** which rests upon a bottom surface of a lower housing section **86**B. In this regard, the spring **84**, which is biased to maintain the cover element **66** in its exposed position relative to the upper housing section **65**A, preferably encircles an opening in the lower housing section **68**B though which extends a bottom end of the post **82**. For coupling the cover element **66** to the post **82**, the cover element **66** may be provided with a cutout for receiving a top end of the post **82**, e.g., via use of friction fit or more permanent fit as desired. Fasteners **86** or the like can be used to releasable couple the lower housing section **68**B to the upper housing section **68**A to thereby form the housing **68** for the cover element **66**, post **82**, and spring **84**.

Positioned adjacent to the opening through which the bottom end of the post **82** is extendable is a printed circuit board (PCB) **88**. While not required, the PCB **88** can be attached to the underside of the lower housing section **65**B by use of fasteners **90** or the like. The PCB **88** carries a switch **96** which is positioned adjacent to the opening in the lower housing section **65**B. Preferably, the switch **96** is in the form of an optical switch. In this manner, when an object rolls over the cover element **66** of the switch assembly **50** as installed on the playfield **14**, the object will force the cover element **66** to move the post **82**, against the biasing force of the spring **84**, and thereby drive the post **82**, via the opening in the lower housing section **65**B, to a position where the end of the post **82** will activate the switch **66**, e.g., to a position that will break the optical connection of the optical switch. Activation of the switch in this manner will cause the PCB **88** to generate a signal for use by the processing device **42** as described above. For allowing the PCB **88** to be releas-

ably coupled to the processing device **42**, the PCB **88** preferably includes a modular, wire/bus receiving connector **92**.

While not required, the PCB **88** may additionally support one or more light emitting diodes (LEDs) **100**. The LEDs **100** may be multicolored LEDs and may be used to illuminate the entire switch assembly **84** or the cover element **66** alone. To this end, the entire switch assembly **50** may be molded from clear plastic materials or the cover element **66** (and other elements excepting the upper housing section **65**A) may be molded from clear plastic materials in keeping with the desired illumination needs.

From the foregoing, it will be appreciated that the subject rollover switch provides various advantages over the prior art. For example, the described rollover switch assembly **50** allows the mounting collar **54** to be installed with the position of the switch assembly **50** then being finely adjusted to thereby ensure that the upper housing **65**A of the switch assembly **50** is positioned flush with the critical top surface of the playfield board after the playfield board has gone thru all of its finishing operations. In addition, the adjustability of the described rollover switch assembly **50** allows the subject rollover switch assembly **50** to be used with playfield boards of varying thickness. Still further, the described rollover switch assembly **50** provides a self-contained sensor package that reduces the required footprint of the device relative to previous implementations, the described use of an optical sensor eliminates the need to adjust the switch, the described use of a modular connector housing increases reliability and ease of manufacturing and service, the described use of surface mount componentry minimizes the package and provides superior reliability, the described compact nature of the overall device gives the game designer greater freedom and allows a designer to place the game device in crowded areas of the playfield to enhance game play, and the described method for making the device provides an assembly that can be quickly and easily disassembled for service or replacement.

While a specific embodiment of the invention has been described in detail, it will be appreciated by those skilled in the art that various modifications and alternatives to those details could be developed in light of the overall teachings of the disclosure. Accordingly, the particular arrangement disclosed is meant to be illustrative only and not limiting as to the scope of the invention which is to be given the full breadth of the appended claims and any equivalents thereof.

What is claimed is:

1. A rollover switch assembly for use with an amusement game having a playfield and an object which moves across a first surface of the playfield, comprising:

a mounting collar sized to be positioned within an opening formed in the playfield wherein the opening extends between a second surface of the playfield and the first surface of the playfield;

a switch assembly having a housing carrying a depressible cover coupled to a switch whereby a depression of the cover in response to contact being made between the cover and the object functions to activate the switch; and

a locking collar;

wherein the mounting collar and the housing of the switch assembly have cooperating features that allow the switch assembly to be adjustably mounted within the mounting collar to thereby allow the cover to be positioned at a desired location relative to the first surface of the playfield, wherein the cooperating elements comprise a first screw thread provided to an interior surface of the mounting collar and a second screw thread provided to an exterior surface of the housing, wherein the locking collar is positionable over the housing and engagable with the mounting collar and the housing to prevent movement of the housing relative to the mounting collar when the switch assembly is positioned as desired within the mounting collar, and wherein the locking collar has a third screw thread provided to an interior surface of the locking collar and the housing has a fourth thread provided to the exterior surface of the housing and wherein the third screw thread and the fourth screw thread cooperate to position the locking collar over the housing.

2. The rollover switch assembly as recited in claim **1**, wherein the locking collar has one or more flanges extending therefrom to provide surfaces for use in grasping the locking collar to rotate the locking collar relative to the housing.

3. The rollover switch assembly as recited in claim **1**, wherein the locking collar has one or more flat surfaces for use in grasping the locking collar to rotate the locking collar relative to the housing.

4. The rollover switch assembly as recited in claim **1**, wherein the switch comprises an optical switch and wherein depression of the cover causes the post element to move in a direction that will activate the optical switch.

5. The rollover switch assembly as recited in claim **4**, comprising a printed circuit board which carries the optical switch, the printed circuit board being mounted to a surface of the housing opposite the cover.

6. The rollover switch assembly as recited in claim **5**, comprising a modular connector mounted to the printed circuit board for releasably coupling the optical switch to a processing unit of the amusement game.

7. The rollover switch assembly as recited in claim **5**, comprising at least one light emitting diode mounted to the printed circuit board for illuminating at least one of the cover and the housing of the optical switch assembly.

* * * * *